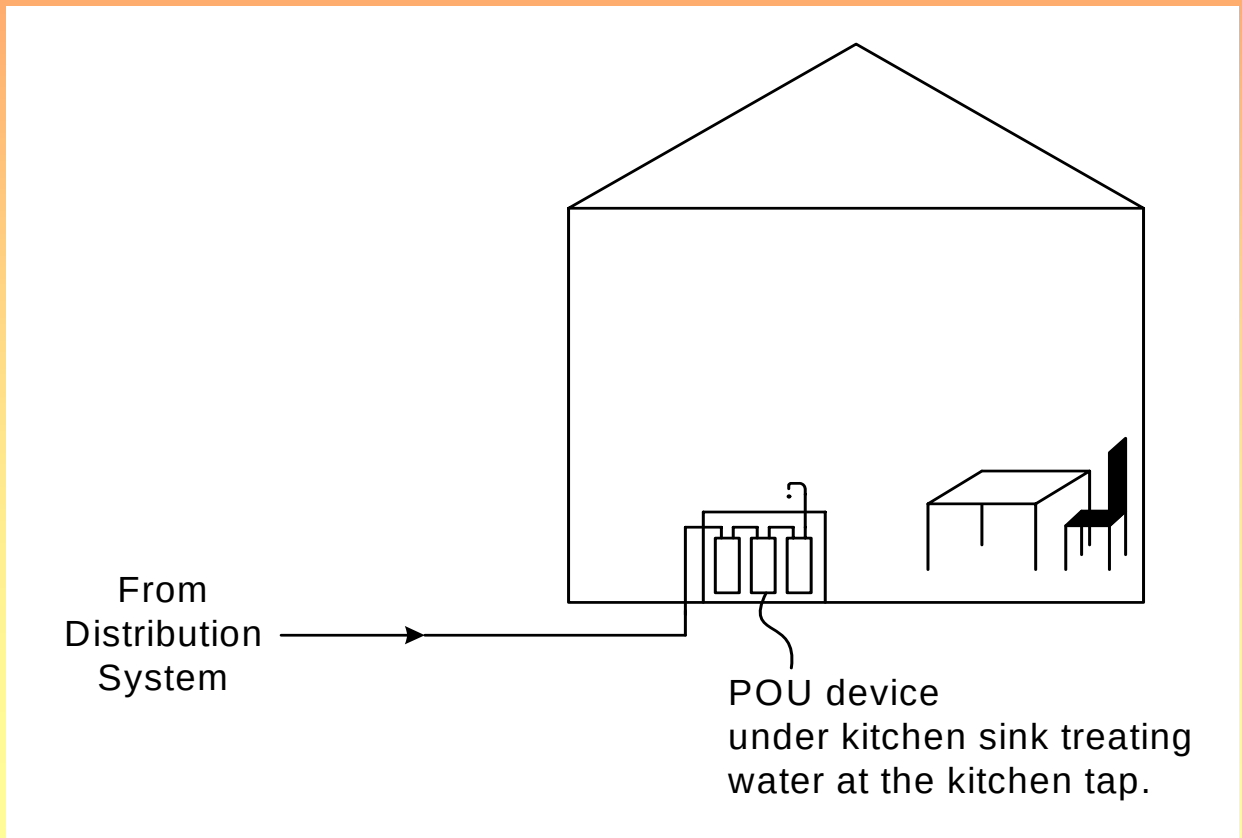
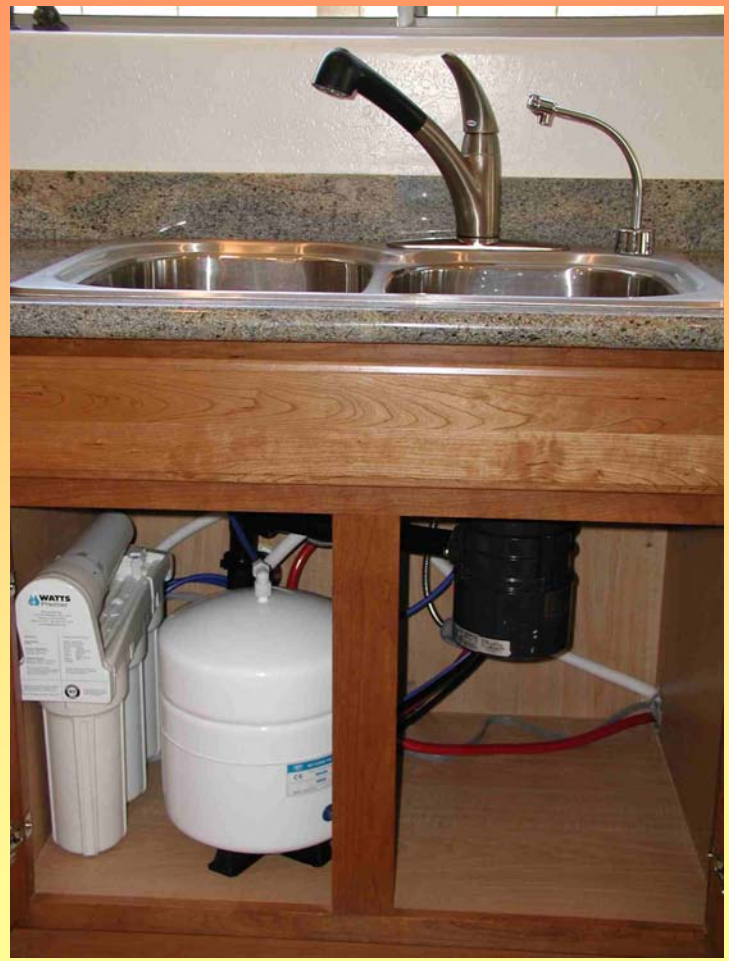
POU/POE for Arsenic Removal

Point-Of-Use (POU)

- **Treats water at a single tap**

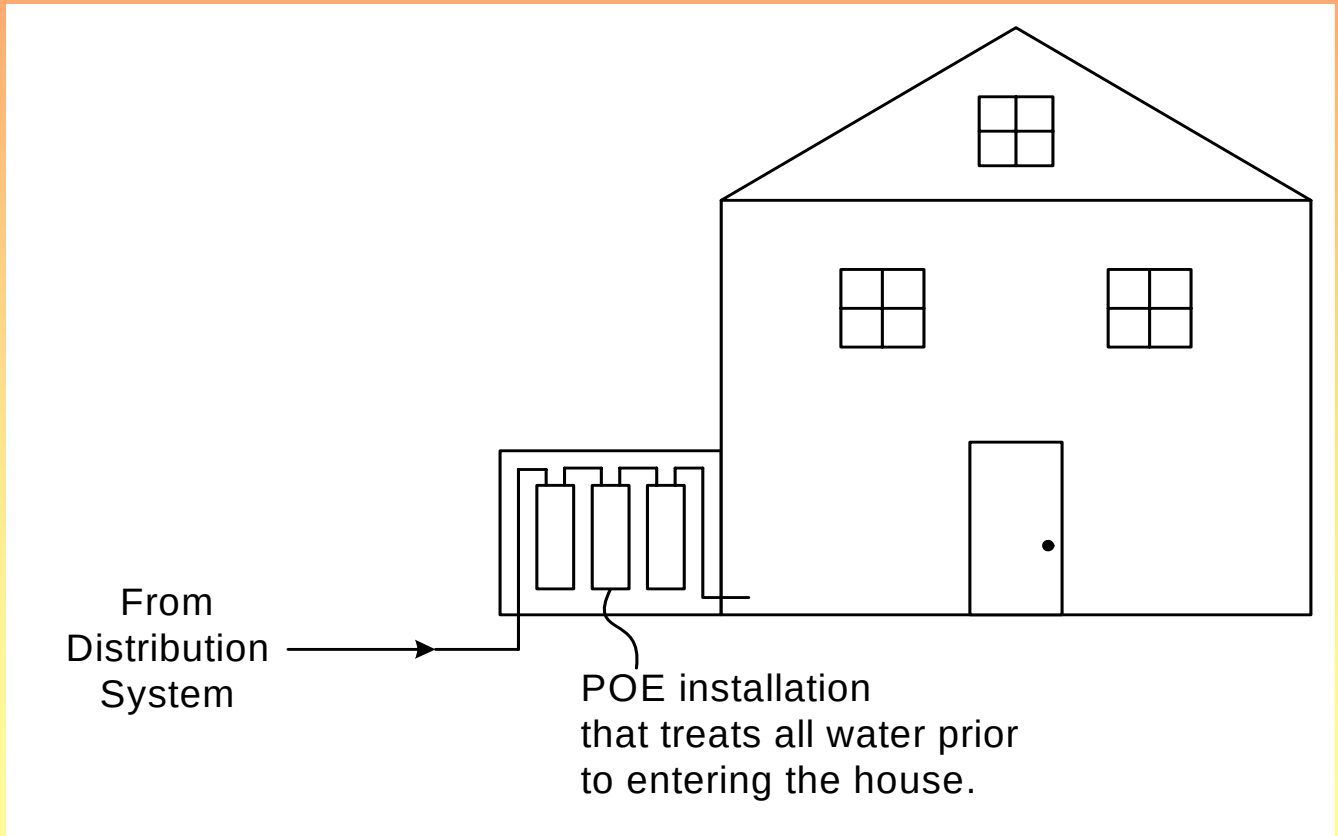


Installed POU RO Unit



Point-Of-Entry (POE)

- **Treats all water entering a building**



Installed POE AA

Safe Drinking Water Act

- List of feasible technologies for small communities – POU and POE
- Owned, operated, and maintained by PWS
- Mechanical warning device
- POU and POE not for microbials
- ANSI certification

SDWA

- **(i) In general.—** Each national primary drinking water regulation which establishes a maximum contaminant level shall list the technology, treatment techniques, and other means which the Administrator finds to be feasible for purposes of meeting such maximum contaminant level, **but a regulation under this subsection shall not require that any specified technology, treatment technique, or other means be used for purposes of meeting such maximum contaminant level.**

Applicable Regulations

- **40 CFR 141.100 (specific to POE)**
  - **PWS must own and operate**
  - **State approved monitoring plan – equivalent health protection as central treatment**
  - **State approved application plan (performance certification, field testing, engineering design) and microbial protection**
- **40 CFR 142.62 (POU and POE for variance and exemptions)**
- **Arsenic Rule - SSCTs for arsenic removal (for systems serving 10,000 or fewer):**
  - **POU Reverse Osmosis**
  - **POU Activated Alumina**

ANSI/NSF Standards

- Standard 44: Cation Exchange Water Softeners
- **Standard 53: Drinking Water Treatment Units-Health Effects**
  - **As (V) - <= 50 ppb and <= 300 ppb**
  - **AS (total) proposed [<= 300 ppb]**
- Standard 55: UV Water Treatment Systems
- **Standard 58: RO Drinking Water Treatment Systems**
  - **As (V) - <=50 and <= 300 ppb**
- **Drinking Water Chemicals and Components – 60 and 61**

Installed ANSI/NSF Certified POU Adsorptive Media Unit

Multi-Pure MP880SB

POU/POE Considerations

- Water Quality
- User agreements
  - Local ordinances
  - Lot use agreements (trailer courts,…)
  - Homeowners association
- Access to homes

Water Quality Considerations

- AX
  - Competing Ion: sulfate
    - AX not recommended if sulfate ≥ 150 mg/L
  - Susceptible to fouling by iron, magnesium, and copper

Water Quality Considerations

- AA
  - Optimal pH for arsenic removal is 5.5 to 6.0
    - pH adjustment typically not feasible for POU AA
  - Competing ions: silica, fluoride, phosphate, sulfate and dissolved iron and manganese
- Iron-based media
  - pH ≤ 8.5
  - Not as sensitive to competing ions

Water Quality Considerations

- RO
  - Cellulose acetate membranes (CAMs) can withstand some chlorine
  - Chlorine damages thin-film composite polyamide membranes (TFMs)
    - Chlorine should be ≤ 0.1 mg/L
    - May use a GAC pre-filter to remove chlorine
  - Ferric iron, manganese, aluminum

    < 0.05 mg/L each (can cause fouling)
  - Excessive particulate can cause fouling

Water Quality Considerations

- **For all POU and POE technologies:**
  - **On-site pilot testing is important.**
    - **Combinations of contaminants in the water may reduce the effectiveness of a technology, even when basic water quality criteria are met.**

Design Considerations

- **POU RO**
  - **CAM (cellulose acetate) vs. TFM (thin film)**
    - **TFM has higher contaminant removal efficiency, but lower chlorine tolerance**

Design Considerations

- POU RO
  - Water recovery rate
    - POU RO - Typically only 25 to 30% of influent volume becomes treated product water
    - Remainder becomes concentrated waste stream
    - May not be suitable in arid regions

Design Considerations

- **All POU and POE technologies:**
  - **Need to consider household demand**
    - **RO approx. 1 gph**
    - **Adsorptive media approx. 5 gph**
    - **May need larger devices for some households**
    - **May need storage depending on instantaneous production rate of device**

Residuals

- **Solids**
  - **Spent cartridges, media, resin, membranes, bulbs, filters, etc.**
- **Liquids**
  - **Spent backwash**
  - **Spent regenerant**
  - **Waste brine**

Residuals Disposal

- Conduct pilot testing to determine quantity and quality of residuals
- POU and POE residuals generated in individual households exempt from Federal regulations as hazardous waste under RCRA
  - However, State regulations and implementation may vary. Contact State on this issue before implementing a POU or POE strategy.

Residuals Disposal

- **Solids**
  - **Generally can be disposed of in household waste, delivered to a landfill, or regenerated.**
- **Liquids**
  - **<u>May usually</u> be discharged to a POTW, on-site septic system, or dry well.**
    - **POTWs may issue limits for discharge of certain contaminants**
  - **May require special handling and disposal if high concentrations of certain contaminants are present**

Residuals Disposal

- Commercial establishments
  - May also be exempt from RCRA if
    - Quantity of hazardous waste generated is considered small (defined in 40 CFR 261.5 as no more than 100 kg in that month)
  - Should contact State or local regulatory agency to assess proper classification and disposal

Costs

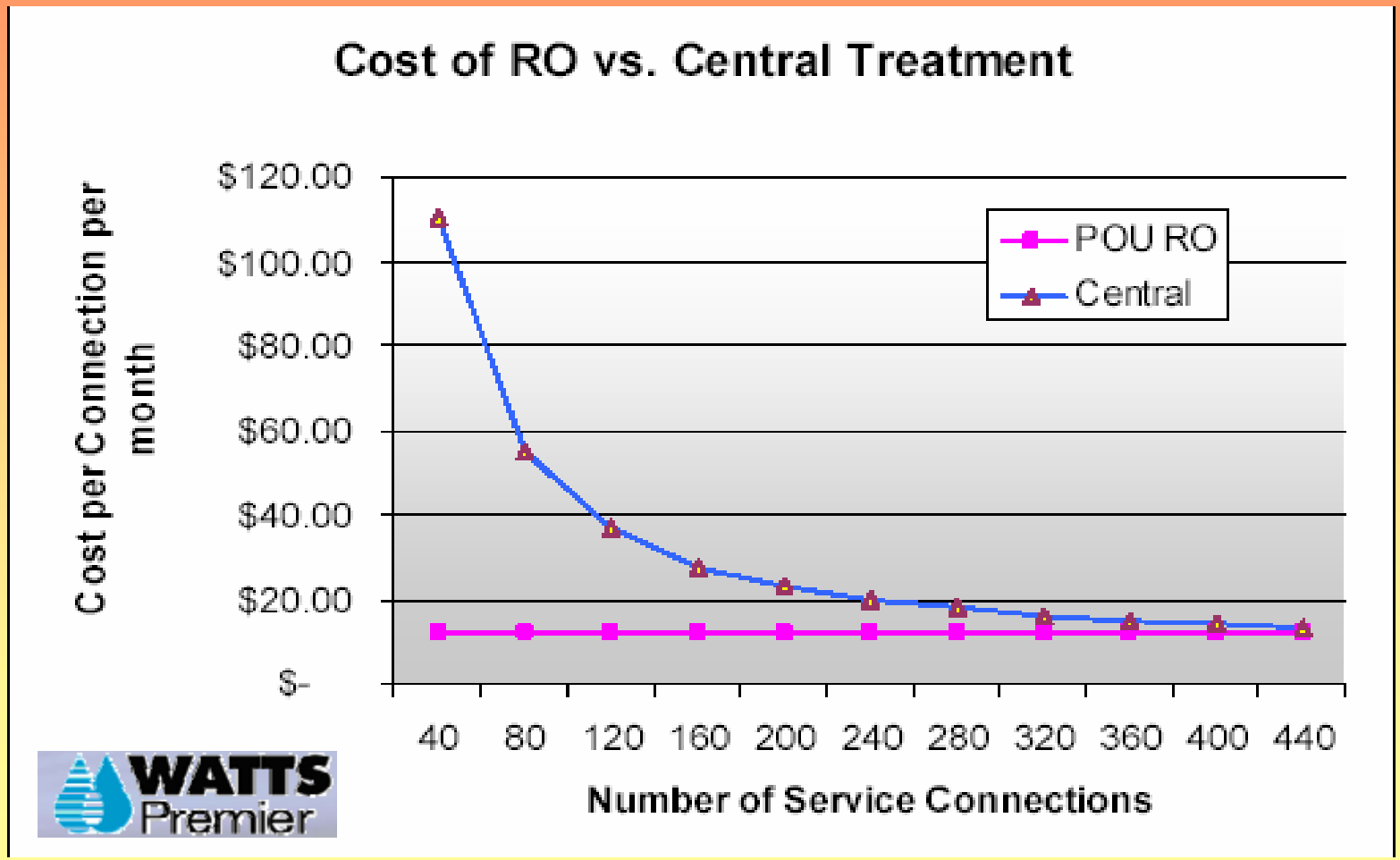
- Alaska and Oregon Case Study (1983 $)
  - AX units - $350
  - AA units - $250
  - RO units - $292
- Lummi Island – POE-AX (2001 $)
  - Base unit $2500 (Average $3400 - $2500-$8000)
- NAS Fallon – POU-RO (2001 $)
  - RO units $300 installed
  - Annual maintenance $129

Cost Evaluation of Small System Compliance Options: Point-of-Use and Point-of-Entry Treatment Units – Under Development

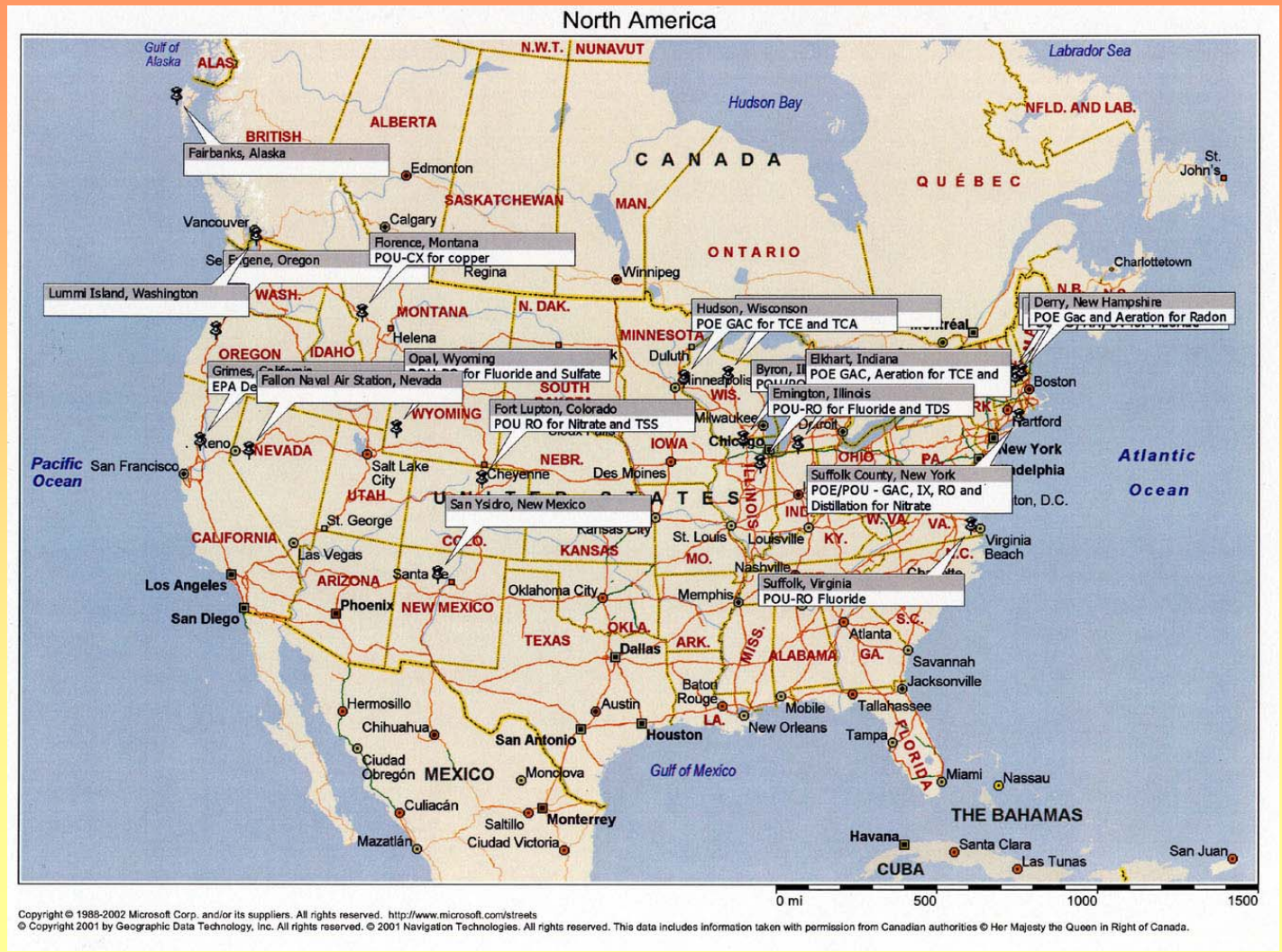
AZ Arsenic Master Plan – POU Cost Estimates

- Avg. Household – 3 people/house – 1gal/day/person
- Installation costs - $150
- Equipment cost – RO-$350 and Adsorption-$150
- Labor costs - $25-installer and $50 administration
- Cost of analysis - $12/sample
- Media replacement – RO $95 and Adsorption-$75

Cost Overview - AZ



Case Studies



Case Study – Grimes, California

POU Adsorptive Media

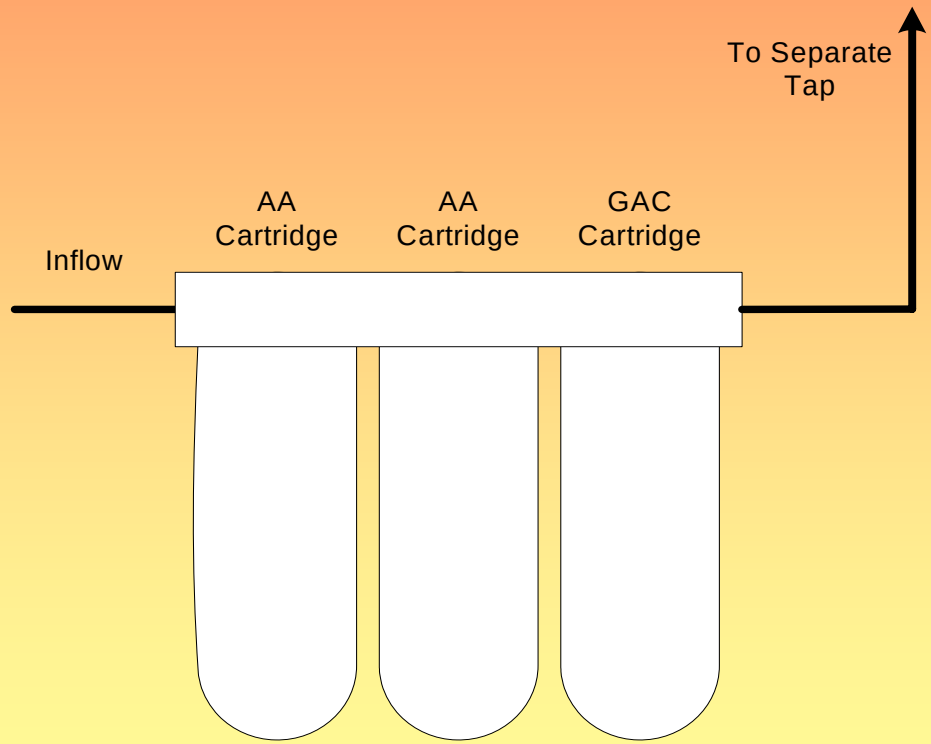
Sacramento, California, United States

Grimes, CA

- **NSF/EPA Demonstration Project**
  - **Supplemental funding from NSF and Kinetico**
- **System demographics**
  - **122 installations (2 RO)**
    - **104 residences**
    - **18 other sites (e.g., school, post office, businesses, day care, etc.)**

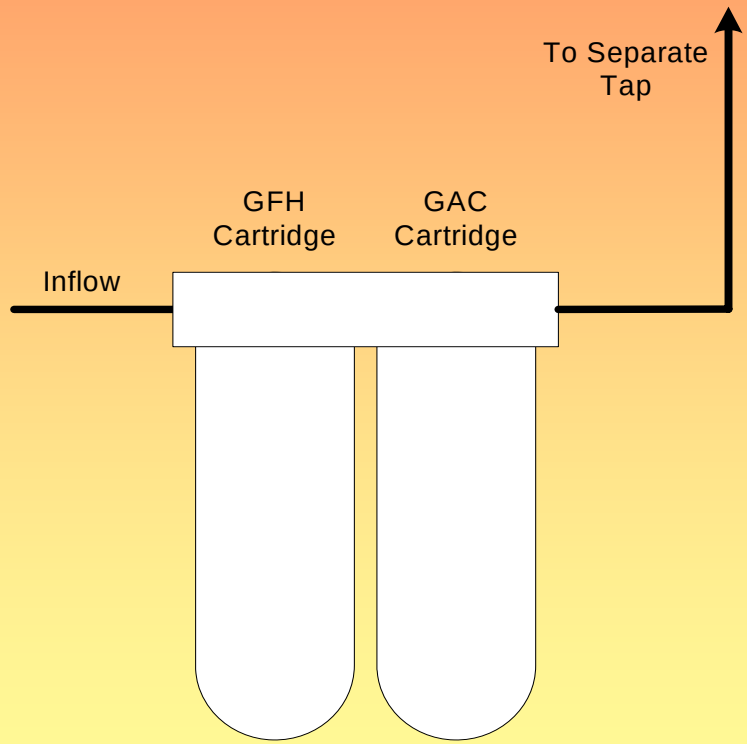
Grimes, CA

POU AA



Grimes, CA

POU GFH



Grimes, CA

- Conclusions
  - As raw water 20-50 ug/L
    As finished water <10 ug/L (all but 2 samples)
  - No replacement within 1 year
  - POU units were donated
  - Monitoring:
    - Analyzed composite sample from 5 POU devices after installation
    - Samples taken quarterly from then on
  - Passed CA WET and TCLP tests

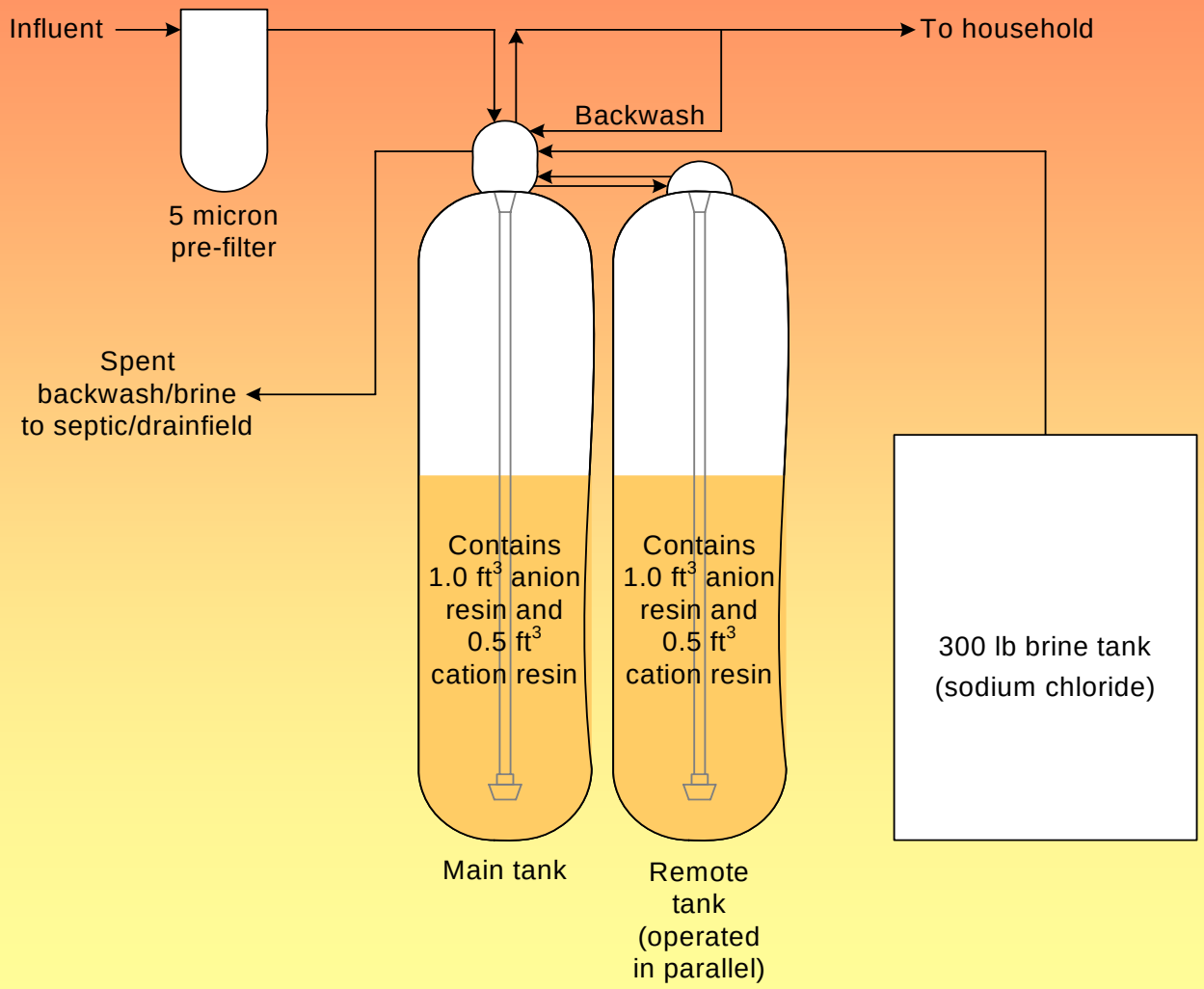
Case Study – Lummi Island, Washington

POE Anion Exchange

Lummi Island, WA

- **POE for Compliance – not a demonstration project**
- **System Demographics**
  - **Subdivision with homeowners association**
  - **Approximately 10 homes**
  - **Classified as Group B water system (not a PWS)**
- **Decision**
  - **Central treatment vs. POE**

Lummi Island, WA

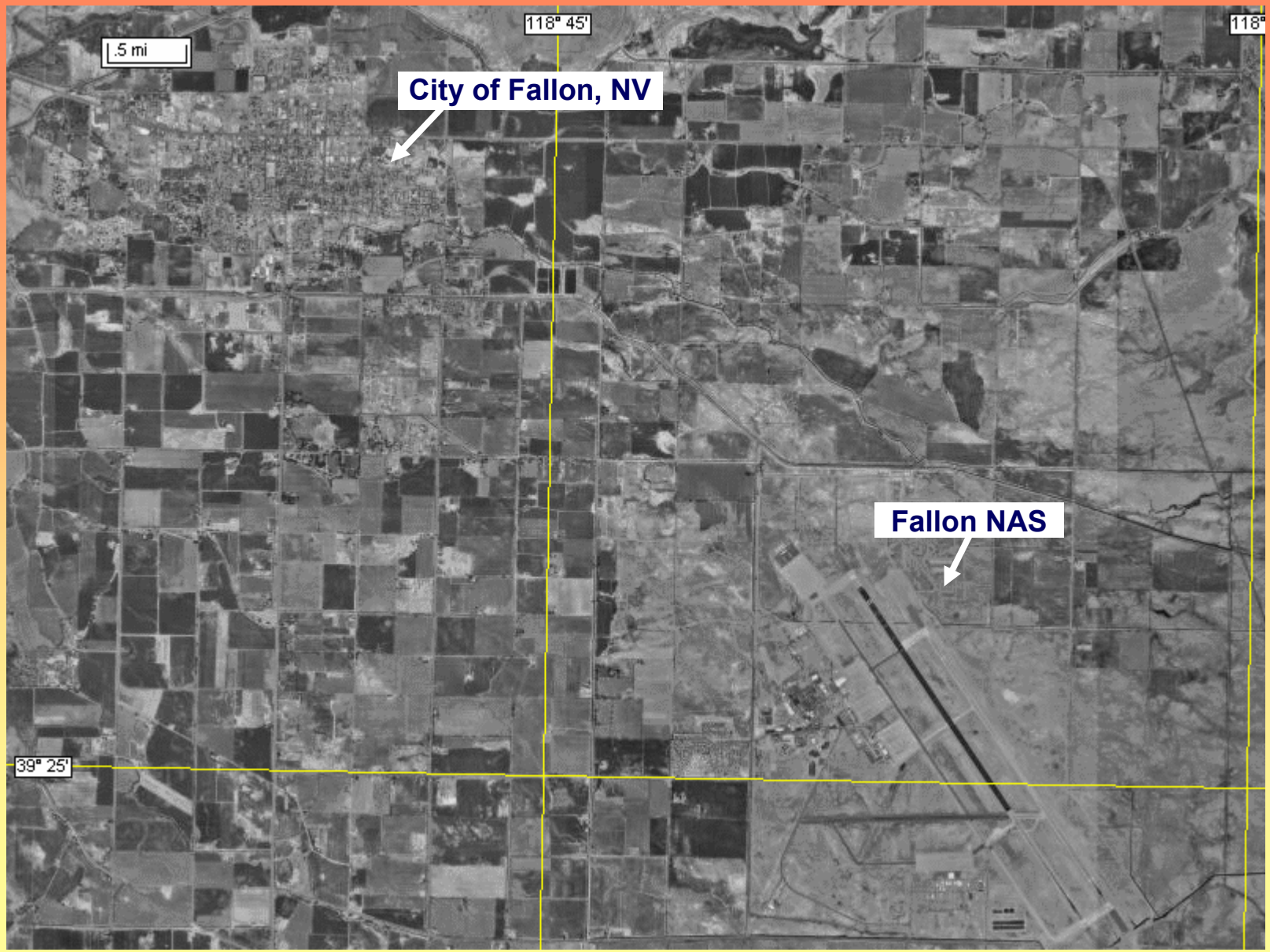


Lummi Island, WA

- Conclusions
  - Approval process took about 4 years
  - Media expected to last about 5 years
    - Expect to dispose of media in household trash
  - $2,500 (base) for POE AX
  - Modifications may be necessary to meet new arsenic MCL
    - Homeowners considering switch to iron-based media

Case Study – Fallon, Nevada

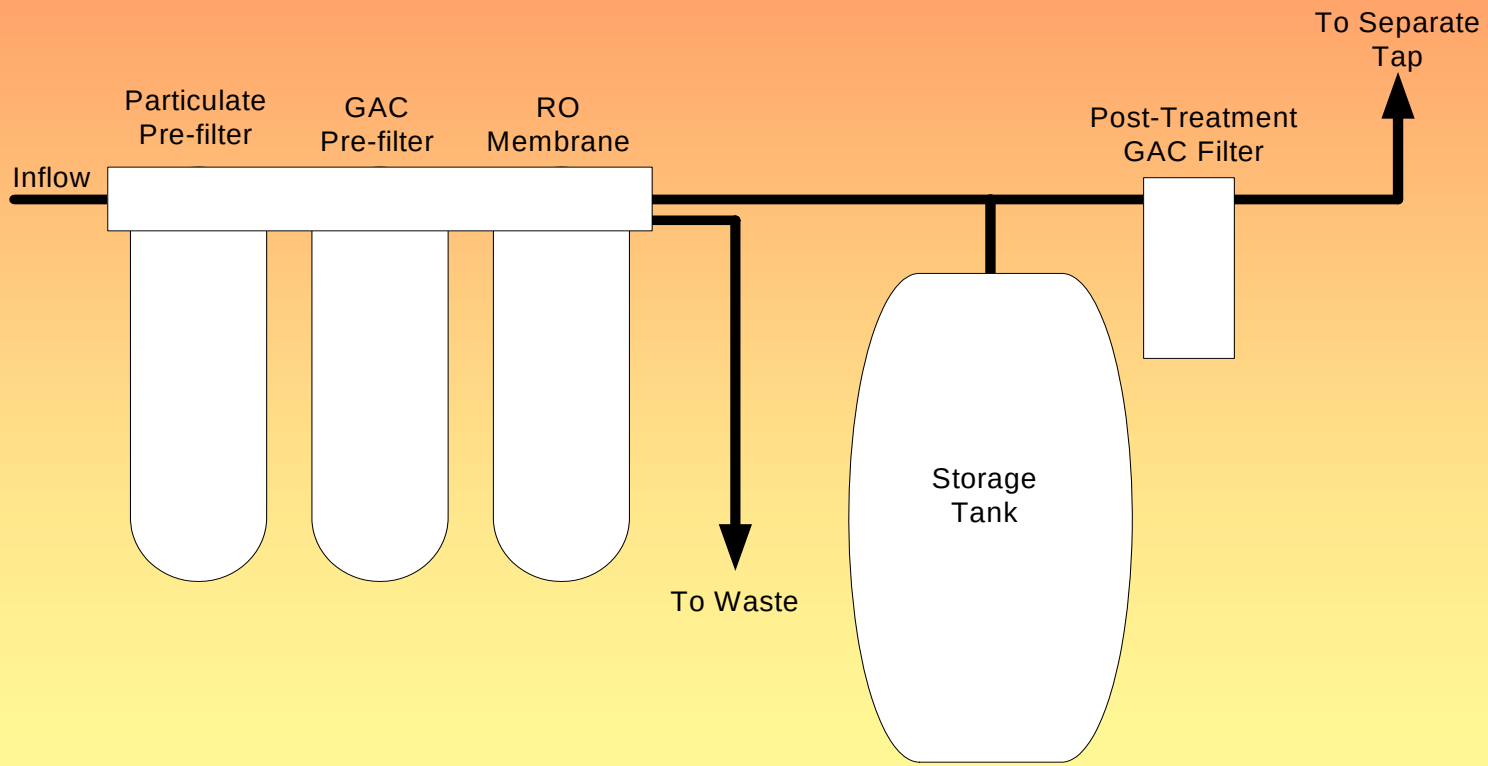
POU Reverse Osmosis


.5 mi
118° 45'
City of Fallon, NV
Fallon NAS
39° 25'

Fallon NAS, NV

- **Naval Air Station**
  - **360 POU RO units installed in base quarters**
  - **75 water cooler style RO machines installed in common areas**
  - **11 RO vending machines for on- and off-base residents to fill bottles**

Fallon NAS, NV



Fallon NAS, NV

- POU RO Costs
  - $300 per unit for purchase and installation
  - $129/yr per unit for maintenance and parts replacement
    - $9 sediment pre-filter cartridge
    - $12 per GAC filter cartridge
    - $55 per RO membrane cartridge

Fallon NAS, NV

- Conclusions
  - As raw water 100 ug/L
    As finished water < DL
  - Military base is unique case for POU
    - Military indoctrination process
    - Access to residential POU RO units
  - POU RO installed as temporary measure

RO – POU: School

Provides water to the kitchen and drinking fountains

Summary

- Has application for some public water supplies (small??)
- Has the same water quality considerations as central treatment
- Costs are declining
- Must be well-tested at the system
- Must have state approved operation, maintenance, and monitoring program
- Must provide equivalent public health protection.